

## Late Preterm Birth

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*In the United States, preterm birth rates continue to rise. Many reasons account for this increase, such as demographic changes, infertility treatments, increases in maternal age, more multiple gestations, increasing obesity rates, and maternal comorbid conditions. The American College of Obstetricians and Gynecologists suggests that preterm birth rates have also increased because of a dramatic rise in late preterm births, defined as births between 34 weeks and 36-6/7 weeks of gestation. Late preterm newborns are the fastest growing subset of neonates, accounting for approximately 74% of all preterm births and about 8% of total births. Reviewed is the current literature with regard to the growing problem of late preterm birth to provide the reader with a comprehensive overview of the burden of late preterm birth and to reassess the clinical opinion regarding timing of delivery.*

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The incidence of premature birth in the United States continues to increase despite extensive research and clinical efforts designed toward its reduction. It has increased from 9.4% in 1981 to 12.3% in 2003, and the most recent data show that the incidence of prematurity in the United States has increased from 12.3% in 2003<sup>1</sup> to 12.7%.<sup>2</sup> Preterm births have increased for many reasons, including demographic changes, infertility treatments, increases in maternal age, more multiple gestations, increasing obesity rates, and maternal comorbid conditions.<sup>3-5</sup> The American College of Obstetricians and Gynecologists (ACOG) suggests that preterm birth rates have also increased because of a dramatic rise in late preterm births (previously referred to as *near term births*) defined as births

between 34 weeks and 36-6/7 weeks of gestation.<sup>6</sup> Late preterm newborns are the fastest growing subset of neonates, accounting for approximately 74% of all preterm births and about 8% of total births.<sup>7</sup> The late preterm birth rate has risen 25% since 1990.<sup>2</sup> Although difficult to glean from published studies, many reasons, such as the increased rate of labor induction (22.3%), increased cesarean delivery rate (30.3%), and increasing prevalence of maternal comorbid factors that increase the likelihood of adverse pregnancy outcome, could contribute to this increase in late preterm birth.

This article reviews the current literature with regard to the growing problem of late preterm birth to provide the reader with a comprehensive overview of the burden of late preterm birth by including a wide range of data from a maximum number of studies. A thorough medical literature review yields a summary that incorporates data from all currently identifiable published studies that have reported neonatal outcomes in the late preterm period.

## Epidemiology

To evaluate the occurrence and impact of a condition, a precise definition and its related outcomes is necessary. Thus, a general classification for selected gestational age categories has been reported.<sup>1</sup> Preterm birth refers to all deliveries < 37-0/7 weeks; this classification includes very preterm (< 32-0/7 weeks), moderately preterm (32-0/7 to 33-6/7 weeks), and late preterm births (34-0/7 to 36-6/7 weeks). Term births refer to deliveries that occur from 37-0/7 to 42-0/7 weeks, and post-term births refer to any delivery occurring after 42-0/7 weeks.

These classifications have evolved over time to help providers evaluate maternal and neonatal morbidities and mortalities. During the past few

decades, preventive and therapeutic interventions focused primarily on low birth weight infants and deliveries occurring at less than 34 weeks. Many clinicians have become increasingly comfortable with births in late preterm gestations and many seemingly choose elective delivery well before 39 to 40 weeks of gestation, mistakenly believing that these neonates may be as physiologically and metabolically mature as term newborns. There is now a growing awareness with regard to late preterm birth due to the unanticipated rate of complications this group has demonstrated.

Neonates born between 34 and 36 weeks of gestation (late preterm or near term births) comprise 71% of all preterm births in the United States.<sup>8</sup> Late preterm neonates have significantly higher rates of morbidity and mortality relative to those born at term (37-42 weeks).<sup>7</sup> In addition to higher risks for serious health complications, the mortality rate for late preterm infants is 3-fold higher than that for term infants (7.7 vs 2.5 per 1000 live births).<sup>9</sup>

With the increase in frequency of late preterm deliveries and its associated increased rate of adverse short- and long-term newborn outcomes,

the increased rate of infections in patients with PPROM, and the increased rate of unfavorable outcomes following sundry maternal medical and obstetrical complications.

## Neonatal Risks

The increased incidence and accompanying risks of late preterm deliveries represent a foremost concern in the United States. It is well known that higher rates of neonatal morbidities accompany delivery at early gestational ages. Infants born after idiopathic preterm labor have higher rates of respiratory distress syndrome (RDS) relative to those born following PPROM. On the other hand, PPROM deliveries have a greater rate of infectious complications compared with those born due to idiopathic preterm labor. Therefore, it seems prudent for published reports to include clinical and demographic data about the parturients studied as well as those excluded from the study. Additionally, neonates with RDS are more often subject to other complications, such as bronchopulmonary dysplasia and reactive airway disease, as well as increased susceptibility to respiratory syncytial virus during the first year of life.<sup>10-12</sup>

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recent attention has focused on the etiology of late preterm births and how this may be distinct from very preterm and moderately preterm births. Important contributing factors are indicated interventions due to maternal pregnancy-related complications such as preterm premature rupture of membranes (PPROM) or fetal indications such as oligohydramnios and intrauterine growth restriction (IUGR). These are compounded by limited tocolytic efficacy,

Numerous confounding variables should be considered when evaluating the complications of prematurity. These include the reasons for preterm delivery, fetal sex, race, presence or absence of intra-amniotic infection, assessment of fetal lung maturity (FLM) prior to delivery, and corticosteroid therapy, among others. Currently, it appears difficult to thoroughly compare and summarize the limited number of published reports as neonatal morbidities vary relative to

the indications for delivery and many potential confounding variables are often not classified. Also, little published information exists regarding the diverse morbidities found in late preterm infants; however, the available evidence suggests that, compared with term neonates, late preterm newborns are at increased risk for feeding difficulty, jaundice, hypoglycemia, temperature instability, apnea, and

and patent ductus arteriosus (PDA) that need to be acknowledged. Also, at 34 weeks of gestation, relatively high rates of neonatal intensive care unit (NICU) admission were noted (16.3%), whereas the admission rate decreased to 4.8% by 36 weeks of gestation (Figure 2). Moreover, the number of NICU admissions varied extensively according to the type of facility. Private institutions had

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respiratory distress.<sup>13</sup> They are also significantly more likely to undergo workup for sepsis, require intravenous fluids, and require mechanical ventilation.<sup>13</sup>

A summary of published neonatal morbidities reported at gestational ages ranging from 34 to 37 weeks is presented in Table 1. There is striking variation in the reported number of complications among published studies. This primarily reflects differences in criteria for diagnosis, with some requiring strict definitions and others relying on coded records. The heterogeneity of the studies prohibits formal statistical analysis and calculation of tests of significance for the pooled neonatal data. However, from a qualitative assessment it is clear that the studies have similar findings. We have combined published data to represent the various studies graphically because this emphasizes an important concept of managing late preterm pregnancies; that is, the expectation of complications changes with advancing gestational age through the late preterm period (Figure 1). The 34- to 35-week groups have increased rates of RDS, sepsis,

higher admission rates and, as expected, increased cost resulted from the greater number of NICU admissions.<sup>15,18</sup> No overall difference was noted in the incidence of intracranial hemorrhage or necrotizing enterocolitis; however, the rate of these complications was low throughout the late preterm period (Table 1).

These limited available data suggest that a significant neonatal risk is evident when delivery occurs between 34 and 37 weeks of gestation. Unfortunately, there are not as yet sufficient outcome data on late preterm births to determine whether the neonatal risk overshadows that of tocolytic therapy, infection following PPRM, maternal and fetal risk associated with preeclampsia, or stillbirth following uteroplacental insufficiency. Consequently, the obstetric care provider is often confronted with having to make the best management decision in an unfavorable situation.

#### **Long-Term Morbidity in the Late Preterm Infant**

The late preterm infant has historically been perceived to have similar risks for developmental problems as

neonates born at term, and thus long-term follow-up of these children has gone largely unobserved.<sup>22</sup> Studies designed to observe clinical outcomes following late preterm births have raised concern that these infants, although they may appear mature and of appropriate size at birth, are at significantly increased risk for medical complications when compared with full-term infants.<sup>13,23</sup> Wang and colleagues compared infants born between 35 and 36 weeks with term infants and found that late preterm newborns were more likely to experience temperature instability, receive intravenous infusions, experience respiratory distress, or become clinically jaundiced; almost 30% of late preterm infants had clinical evidence of respiratory distress, and one-third of those required a prolonged hospital stay.<sup>13</sup> Increased incidence of respiratory distress was also reported by Escobar and associates when they examined outcomes of infants born between 35 and 36 weeks.<sup>23</sup> Eight percent of these preterm neonates required supplemental oxygen support for at least 1 hour, which is 3 times the rate found in term neonates. They were also twice as likely to be rehospitalized after the immediate perinatal period.<sup>23</sup>

The effect of these complications on long-term neurodevelopmental outcome in the late preterm infant is largely unknown, but there is growing alarm that these infants are more vulnerable to brain injury and long-term neurologic sequelae than previously appreciated.<sup>24</sup> Furthermore, infants born during the late preterm period are at more than 3-fold increased risk of developing cerebral palsy compared with term infants.<sup>13</sup> The last 6 weeks of gestation is a critical period of growth and development of the fetal brain. Brain weight at 34 weeks is only 65% of that of the term brain, and gyral and sulcal formation is incomplete. Cortical volume

Table 1  
Incidence (%) of Preterm Gestational Complications

34 Completed Weeks							
Reference	N	Necrotizing Enterocolitis	RDS	Intracranial Hemorrhage	Sepsis	NICU Admission	PDA
McIntire and Leveno <sup>14</sup>	3498	3	116	16	18	165	—
Jones et al <sup>15</sup>	370	—	45	—	—	202	—
Robertson et al <sup>16</sup>	229	7	31	0	8	161	4
Arnon et al <sup>17</sup>	60	—	9	—	3	27	—
Elliott et al <sup>18</sup>	193	—	18	—	—	103	—
Konte et al <sup>19</sup>	40	0	9	0	2	29	5
Lubow et al <sup>20</sup>	49	—	3	—	4	33	—
Lewis et al <sup>21</sup>	121	—	18	—	—	24	—
Total	4560	10/3,767 (0.27%)	249/4560 (5.4%)	16/3767 (0.42%)	35/3997 (0.88%)	744/4560 (16.3%)	9/269 (3.34%)
35 Completed Weeks							
McIntire and Leveno <sup>14</sup>	6571	1	109	14	23	137	—
Jones et al <sup>15</sup>	783	—	71	—	—	225	—
Robertson et al <sup>16</sup>	298	1	19	0	7	124	4
Arnon et al <sup>17</sup>	54	—	7	—	3	8	—
Elliott et al <sup>18</sup>	398	—	28	—	—	128	—
Konte et al <sup>19</sup>	36	0	1	0	2	8	0
Lubow et al <sup>20</sup>	50	—	4	—	2	30	—
Lewis et al <sup>21</sup>	156	—	1	—	—	3	—
Total	8346	2/6,905 (0.03%)	240/8346 (2.88%)	14/6905 (0.20%)	37/7009 (0.53%)	663/8346 (7.94%)	4/334 (1.2%)
36 Completed Weeks							
McIntire and Leveno <sup>14</sup>	11702	1	89	8	26	126	—
Jones et al <sup>15</sup>	1696	—	92	—	—	283	—
Robertson et al <sup>16</sup>	544	5	18	0	7	131	2
Arnon et al <sup>17</sup>	93	—	3	—	0	7	—
Elliott et al <sup>18</sup>	947	—	34	—	—	165	—
Lubow et al <sup>20</sup>	50	—	2	—	0	12	—
Lewis et al <sup>21</sup>	156	—	0	—	—	2	—
Total	15,188	6/12,246 (0.049%)	238/15,188 (1.57%)	8/947 (0.84%)	33/12,389 (0.27%)	726/15,188 (4.78%)	2/544 (0.37%)

NICU, neonatal intensive care unit; PDA, patent ductus arteriosus; RDS, respiratory distress syndrome.

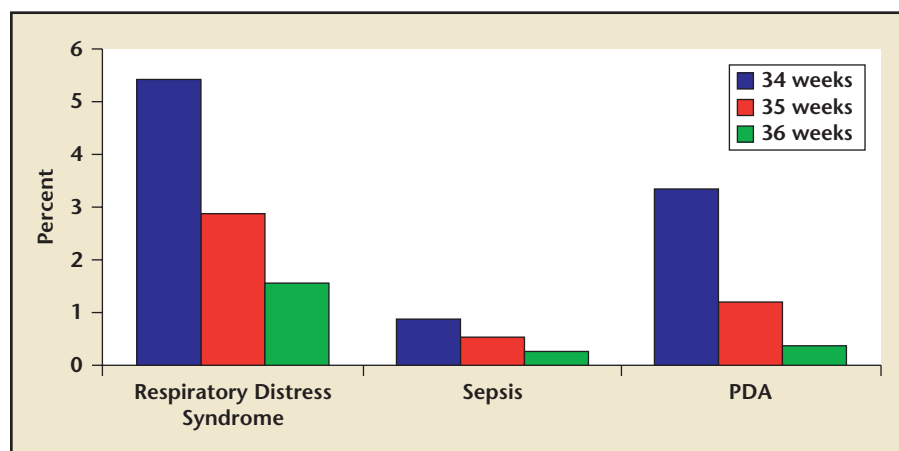


Figure 1. Rate of respiratory distress, sepsis, and patent ductus arteriosus (PDA) by gestational age.

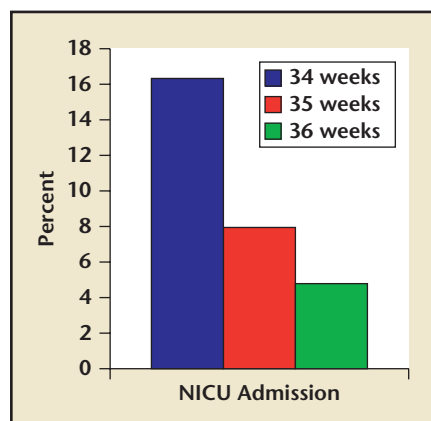


Figure 2. Rate of neonatal intensive care unit (NICU) admission by gestational age.

increases by 50% between 34 and 40 weeks' gestation, and 25% of cerebellar development occurs during this same period of time.<sup>24</sup> The implication of brain immaturity in this population needs to be studied further, but there appears to be some increased susceptibility to injury that could have lasting effects. The late preterm neonate has a 2- to 5-fold increased risk of developing significant hyperbilirubinemia.<sup>24,25</sup> When compared with term newborns with similar bilirubin levels, late preterm infants are more likely to have severe neurologic

sequelae and neurotoxicity has been noted at earlier postnatal ages. Moreover, once treated, late preterm infants have a lower success rate for complete recovery with minimal or no sequelae.<sup>25</sup>

Limited published data exist regarding the long-term morbidity associated with late preterm birth, but research in this area is emerging. Bastek and colleagues examined the risk of adverse neonatal outcomes in late preterm infants compared with those born at term. The authors reported that infants born between 34-0/7 and 34-6/7 weeks of gestation had a 9-fold increased risk for having an outcome characterized by long-term morbidity and persistent use of health care resources.<sup>26</sup> General health status was also examined by Klassen and colleagues in a cohort of preschoolers who were previously admitted to the NICU after delivery.<sup>27</sup> In this study, NICU graduates born between 33 and 37 weeks reported more medical problems in all areas assessed as compared with children born at term.

In addition to apparent health concerns, there is also a growing recognition that this population may have more subtle neurodevelopmental

issues such as inferior academic performance or behavioral problems.<sup>28-32</sup>

When a cohort of children born between 32 and 35 weeks of gestation were examined for their extent of educational problems, approximately one-third had some form of academic difficulty and one-fourth were receiving nonteaching assistance at school.<sup>30</sup> However, this study lacked a control group so no definitive conclusions could be made about the incidence of these academic complications compared with term infants. Kirkegaard and colleagues evaluated the association between gestational age at birth, birth weight, and learning disabilities in a cohort of children aged 9 to 11 years.<sup>31</sup> Children born between 33 and 36 weeks had a significant (50%) increased risk of having reading difficulties, but these differences disappeared after adjustment for parental education level, gender, and breastfeeding. The authors concluded that there was no significant association between gestational age at birth and arithmetic difficulties.<sup>31</sup> The authors pointed out a few limitations in their study, including a small sample size and considerable loss to follow-up. A more recent and larger study looking at school outcomes from kindergarten through fifth grade in late preterm infants compared with term infants did find a significant difference in academic performance between the 2 groups.<sup>28</sup> Outcomes were measured by standardized testing, teacher evaluations, and the utilization of individualized education programs (IEPs) and special education services. After adjustment for sex, race, and maternal educational level, those children born between 34 and 36 weeks had a 24% increased risk for below-average reading scores in the first grade, and were 1.3-times more likely to have below-average reading competence at all grade levels as evaluated by their teachers. They were



also noted to have below-average ability in mathematics as compared with term infants in kindergarten, but this difference was not seen in later grades. Late preterm birth was associated with a greater need for IEPs at early school ages, and up to a 2-fold increased risk for special education.<sup>28</sup>

Although the data are limited, they consistently suggest that late preterm infants have a higher rate of behavioral problems than children born at term.<sup>29,30,32</sup> Gray and associates reported a 19% to 20% prevalence of behavior problems at age 8 in infants born between 35 and 37 weeks, which is twice the 10% prevalence in the normal population.<sup>29</sup> Studies by Huddy and colleagues and McCormick and associates reported a 20% prevalence of hyperactivity, behavioral, or emotional problems in children born in the late preterm period.<sup>30,32</sup>

### Financial Considerations

The total cost of late preterm births is derived from the cost of antepartum management, delivery costs, neonatal treatment costs, and the need for long-term medical, educational, and social services for many of these infants. When evaluating the direct neonatal cost relative to gestational age for all deliveries during 1996, Gilbert and colleagues found a significant inverse correlation between gestational age at delivery and cost.<sup>33</sup> These findings have been validated by similar studies.<sup>18</sup> Additionally, St. John and associates reported that neonates delivered before 37 weeks of gestation account for only 9% of all live births, but more than 57% of all neonatal costs.<sup>34</sup> By their calculations, the late preterm group alone accounted for 11.2% of all neonatal costs (\$1.145 billion annually) despite the fact that they comprised only 6.2% of all deliveries. Because the neonatal costs do not include the obstetric cost, both the neonatal and maternal expenses

should be considered when attempting to demonstrate a valid financial savings to the health care system.

Pregnancy accounts for approximately 25% of all hospitalizations in women.<sup>35</sup> The cost of antepartum admission exceeds that of admissions for delivery (mean \$6900 vs \$6200, respectively)<sup>35</sup> and thus the costs for the care of those pregnancies complicated by antepartum admission is additive. Preterm labor accounts for the greatest percentage of antepartum admissions. According to the 2006 Institute of Medicine report on preterm birth, the total annual cost of preterm birth in the United States is now estimated to be more than \$26 billion per year.<sup>36</sup> This estimate includes the cost of maternal care, neonatal care, and long-term need for services, but does not include medical costs outside of early childhood or caregiver costs. According to this analysis, the overall average cost is approximately \$51,600 per preterm infant, but this decreases with increasing gestational age at birth.<sup>18,33,34</sup> Although it is difficult to assign a cost to emotional harm, preterm birth and its associated comorbidities has a significant psychological as well as financial impact. High-risk pregnancy and preterm birth are significant family stressors.<sup>37</sup>

of health care spending on prematurity-related care involves cases at the threshold of viability; however, the higher number of late preterm births contributes a considerable portion of the overall cost. In 2002, there were approximately 360,000 late preterm births or 74% of all preterm births.<sup>7</sup> The average cost for an individual infant born at 34, 35, and 36 weeks has been estimated at \$7200, \$4200, and \$2600, respectively.<sup>38</sup> However, the prevalence of delivery increases with increasing gestational age. Thus, when the total number of births at each gestational week is taken into consideration, the estimated annual cost to the US economy of neonatal care for infants born at these same gestational weeks is \$41.4 million, \$41.1 million, and \$42.8 million, respectively.<sup>38</sup>

Late preterm births are the fastest growing segment of singleton preterm births.<sup>7</sup> A delay in delivery from 34 to 35 weeks provides a 42% decrease in the average neonatal cost, whereas a delay from 35 to 36 weeks results in a further 38% cost decrease. Although this cost reduction should not provide a rationale for delaying delivery when indicated for either fetal or maternal complications, it may warrant an attempt to delay delivery in cases of spontaneous preterm labor. Conse-

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*A delay in delivery from 34 to 35 weeks provides a 42% decrease in the average neonatal cost, whereas a delay from 35 to 36 weeks results in a further 38% cost decrease.*

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The impact of a preterm birth on the long-term quality of life within families should not be underestimated.

The increasing rate of premature birth and improved neonatal care technology has resulted in a disconcerting combination from an economic aspect. As more expensive treatment regimes for the premature neonate are developed and used, the associated costs continue to escalate. The vast majority

quently, future studies could consider the cost effectiveness of endeavors to delay delivery during the late preterm period and its potential effect on the reduction of neonatal morbidity.

### FLM Testing in Late Preterm Gestations

FLM testing is of uncertain value in late preterm gestations. Wigton and colleagues reported that few neonates

develop morbidities associated with prematurity if delivered with a lecithin-to-sphingomyelin ratio (L/S)  $> 2.0$  or the presence of phosphatidylglycerol in amniotic fluid.<sup>39</sup> More recently, Lewis and colleagues examined the rate of RDS in late preterm neonates delivered following a “mature” TDx FLM-II test (defined as  $> 55$  mg surfactant/mg of albumin) and found that there was a surprisingly high rate of RDS at 9.8%.<sup>40</sup> Ghidini and associates reported an even higher rate of RDS (26.7%) in preterm neonates delivered with “mature” fetal lung testing results using the L/S ratio.<sup>41</sup> Pinette and colleagues<sup>42</sup> published a table of expected RDS rates with varying FLM values by gestational age based on the logistic regression equation derived by Tanasijevic and associates.<sup>43</sup> Their mathematical model would predict a 3.4% to 10% risk of RDS using gestational age-specific cutoffs for the TDx FLM-II assay, but this model has never been tested prospectively. Because of the uncertainty in the interpretation and the published data suggesting a higher than expected rate of RDS in neonates delivered following “mature” results, we caution against the use of FLM testing as an indication for elective delivery in the late preterm period.

### **Obstetric Indications for Preterm Birth**

The relative contribution of pregnancy-specific complications to the overall burden of preterm birth has been well described for births occurring prior to 37 weeks of gestation. But, because the causes of preterm labor change with advancing gestational age, the distribution of preterm birth subtypes differs with differing gestational ages.

#### *Etiology of Preterm Birth < 37 Weeks*

The general distribution of preterm birth subtypes for births occurring at

less than 37 weeks of gestation has been broadly categorized into 2 groups. These include: (1) indicated or iatrogenic births occurring due to an adverse maternal or fetal condition, and (2) spontaneous, which includes cases of unexplained preterm labor and PPROM. Approximately 25% of all preterm births are medically indicated and the remaining 75% are spontaneous in nature.<sup>44</sup> Of spontaneous preterm deliveries, approximately 60% are the result of preterm labor and 40% are due to PPROM.<sup>45</sup> Of indicated preterm births, the most common etiologies are preeclampsia (40%), nonreassuring fetal testing (25%), IUGR (10%), placental abruption (7%), and fetal death (7%).<sup>46,47</sup>

There are many medical complications that can lead to idiopathic preterm birth. Some pregnancy-specific complications include preeclampsia, IUGR, oligohydramnios, Rh disease, congenital malformations, and nonspecific conditions resulting in nonreassuring fetal status or fetal death. Preexisting maternal medical conditions may compromise the well-being of the pregnancy and lead to preterm birth. Some of the more common causes of maternal medical conditions leading to preterm birth include pregestational diabetes, chronic hypertension, cardiac disease, renal disease, and autoimmune disorders.

The ratio of indicated to spontaneous preterm births has remained fairly stable over time with spontaneous preterm births far outnumbering the births resulting from maternal or fetal indications. Over the past few decades, there has been a trend toward a relative increase in indicated preterm births compared with spontaneous preterm births that has coincided with a decreasing rate of intrauterine fetal death (stillbirth).<sup>44</sup> It has been suggested that improved perinatal diagnostic modalities have enabled obstetric care providers to

better identify fetuses at risk and recommend delivery of pregnancies that otherwise may have resulted in preterm fetal deaths.

Because the likelihood of significant neonatal morbidity decreases with advancing gestational age, obstetric care providers have a lower threshold to recommend delivery for complicated pregnancies as they approach term. For example, preeclampsia diagnosed at an extremely preterm gestational age would require a significant degree of severity to prompt delivery compared with a case of mild preeclampsia at 36 weeks of gestation. Likewise, pregnancies complicated by IUGR are more likely to be managed expectantly at an early gestational age compared with the same clinical situation at or after 34 weeks' gestation.

Spontaneous preterm labor is also managed differently after 34 weeks than at an earlier gestational age. Tocolytic medications, for example, have demonstrated limited utility to prolong gestation longer than 24 to 48 hours and have not been directly associated with improvements in neonatal outcomes.<sup>45</sup> Therefore, the use of tocolytic medication is generally reserved for short-term therapy (48 hours) to allow for administration of a full course of antenatal corticosteroids prior to 34 weeks of gestation.<sup>45</sup> Spontaneous etiologies of preterm parturition comprise a higher ratio of overall preterm births near term than at earlier gestational ages. This may be a reflection of changes in the pathophysiologic mechanisms of spontaneous preterm labor at later gestational ages and the tendency toward less aggressive management to prolong gestation after 34 weeks.

#### *Etiology of Late Preterm Birth From 34-0/7 to 36-6/7 Weeks*

Compared with births  $< 34$  weeks, late preterm births are more likely to be

the result of spontaneous idiopathic preterm labor or PPROM than medical or pregnancy indications.<sup>48</sup> It has been estimated that the relative distribution of etiologies of preterm birth < 34 weeks' gestation is 30% indicated, 30% PPROM, and 40% spontaneous preterm labor. For late preterm births, the relative distribution of etiologies changes to 20% indicated, 25% PPROM, and 55% preterm labor.<sup>45</sup> As such, a larger proportion of late preterm births are due to spontaneous preterm labor (two-thirds) compared with PPROM (one-third).<sup>48</sup> On the other hand, the causes of indicated late preterm births are similar to that for all preterm births, including preeclampsia (46%), fetal indications (18%), placental abruption (14%), and other indications (20%).<sup>49</sup>

### Unintended Preterm Birth

Unintended preterm birth (or iatrogenic prematurity) is an underappreciated contributor to the burden of preterm birth. Unintentional prematurity may occur as the result of inaccurate gestational age assessment, which can be compounded if a planned elective delivery is proposed prior to 39 weeks of gestation. ACOG has proposed strict guidelines for gestational age assessment with the intention of minimizing the risk of unintended prematurity. Furthermore, ACOG has mandated that elective delivery only take place after 39 weeks

pregnancies). Despite these clear recommendations, some providers continue to offer a planned elective delivery prior to 39 weeks of gestation without documenting FLM. This is not only inappropriate, but potentially dangerous because it can lead to unintentional late preterm birth with its accompanying complications.

So how common are elective late preterm births? Stated differently, what proportion of late preterm births are avoidable? For obvious reasons, elective preterm deliveries are likely underreported. In a recent retrospective cohort study of late preterm births (34–37 weeks) at a single tertiary care institution, the authors concluded that less than 10% of late preterm births in this cohort were purely elective and greater than 80% were clearly unavoidable.<sup>51</sup> These data suggest that the adverse perinatal outcome seen in infants born in the late preterm period may be due to the underlying medical or obstetric condition that prompted the early delivery in the first place, and not due to the gestational age at delivery alone.

### Conclusions

Because of the excess short- and long-term neonatal morbidity and associated costs, obstetric care providers should reevaluate the need for delivery during the late preterm period (34–0/7 to 36–6/7 weeks). A reduction

opinions about timing of delivery. Because published data reveal that some harm may occur as a result of unnecessary late preterm births, the practice of preterm delivery without a clear indication merits strict reevaluation. ■

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*Unintentional prematurity may occur as the result of inaccurate gestational age assessment, which can be compounded if a planned elective delivery is proposed prior to 39 weeks of gestation.*

of gestation in well-dated pregnancies.<sup>50</sup> An earlier elective delivery can only be considered after documentation of FLM (with 2 exceptions in which elective delivery can be performed at 38 weeks without documentation of FLM: HIV and multiple

in the number of newborns exposed to unnecessary risks due to elective delivery in the later preterm period would have great societal benefit. In an era where both the quality and cost of care are of paramount importance, we must reassess our clinical



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## Main Points

- Premature birth rates continue to rise in the United States despite research and clinical efforts designed toward their reduction. Rates rose from 9.4% to 12.3% between 1981 and 2003, with most recent data showing the incidence at 12.7%.
- Preventive and therapeutic interventions over the past few decades have focused primarily on low birth weight infants and deliveries occurring at < 34 weeks. Many clinicians have now become increasingly comfortable with births in late preterm gestations and many seemingly choose elective delivery well before 39 to 40 weeks' gestation, although there is a growing awareness of the unanticipated rate of complications demonstrated with late preterm births.
- Expectation of complications changes with advancing gestational age through the late preterm period. The 34- to 35-week gestational groups have increased rates of respiratory distress syndrome, sepsis, and patent ductus arteriosus. At 34 weeks' gestation, relatively high rates of neonatal intensive care unit admission were noted (16.3%), whereas the admission rate decreased to 4.8% by 36 weeks' gestation.
- Late preterm births may result in increased risk for medical complications compared with full-term infants. Recent studies have shown that infants born between 35 and 36 weeks were more likely to experience temperature instability, need intravenous infusions, experience respiratory distress, or become clinically jaundiced. In addition to apparent health concerns, there is growing recognition that this population may have more subtle neurodevelopmental issues such as inferior academic performance or behavioral problems.
- Total annual costs of preterm birth in the United States are now estimated to be > \$26 billion per year, which include the cost of maternal care, neonatal care, and long-term need for services, although they do not include medical costs outside of early childhood or caregiver costs. The overall average cost is approximately \$51,600 per preterm infant, but decreases with increasing gestational age at birth.
- Due to the excess short- and long-term neonatal morbidity and associated costs, obstetric care providers must reevaluate the need for delivery during the late preterm period (34-0/7 to 36-6/7 weeks). Reducing the number of newborns exposed to unnecessary risks due to elective delivery in the later preterm period would have great societal benefit.

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